Attachment 1

Approval of Electronic Components in Aircraft Seating Systems

Background

The introduction of In Flight Entertainment (IFE) and other electronic equipment on Technical Standard Order (TSO) commercial aircraft seating systems has created certification challenges for these components. In that regard, the FAA and industry assembled for a workshop on the subject. The process described below for the airworthiness approval of electronic components installed on seats is derived, in part, from an industry position paper dated May 19, 1998 which resulted from the workshop.

Aircraft seats and some of the seat-mounted electronic components have different product life cycles. Changes to seats and their electronic components occur frequently and independently in response to market demands. The FAA, in recognition of these facts, has adopted the following methods of achieving full compliance.

Summary

TSO and Type Certification/Supplemental Type Certification (TC/STC) approvals are the only acceptable means of compliance and are described below. The TSO approval process includes TSO Authorization (TSOA) and Letter of Design Approval (LODA). Design features/characteristics of seat-mounted electronics that are significant to the TSO approval process are specifically identified. Other design features/characteristics are identified as part of the TC/STC approval process and may not be unique to a specific aircraft type.

The objective of these procedures is to allow as much independence as possible between the approval process for seats and that of the seat-mounted electronics. Where independence is not feasible, two methods of handling the limitations associated with TSO-significant design features/characteristics provide clear approval traceability for different types of electronic components while offering flexibility.

Approval Process

Designing, certifying and conforming electronics in aircraft seats is a shared responsibility. The seat manufacturer, the electronic component supplier and the TC/STC applicant all must work together. There are design features/characteristics of the electronics that are clearly interdependent with the seat design while other features/characteristics are of no significance to the seat design but are interdependent with the airplane installation.

The following outlines the two methods for integrating electronics into the seat through the existing certification processes. Either process may be used for different electronic components on the same seat.

TSO Approval: The TSO approval process involves the electronics installed and called out as part of the TSOA or LODA approved seat assembly (either TSO-C39 or TSO-C127). In this case, the seat manufacturer is required to have design control of those design features/characteristics of the electronic components included in the TSO article (see Seat TSO Design Features/Characteristics below). The manufacturer also is responsible for the quality control (QC) per 14 CFR 21.601(b)(5) of those electronic component design features/characteristics. In addition, the seat manufacturer may be required by the TC/STC holder to obtain sufficient data on other airplane installation design features/characteristics of the electronic components from the electronics supplier (see TC/STC Design Features/Characteristics below). While design requirements may be split by design features/characteristics, the QC system must be able to handle all design features/characteristics of the completed parts.

Since the electronics have other design features/characteristics that are important to the airplane installation, the seat TSO limitations should indicate which, if any, features/characteristics are covered under the TSO approval. The remaining installation design features/characteristics must be substantiated during airplane installation under TC/STC approval. Allowing design features/characteristics to be stipulated in the seat TSO limitations document gives the seat TSOA or LODA holder the ability to limit the type of electronic components installed on the seat without specifying the specific part number. This has the effect of passing the complete design approval and QC responsibility to the seat assembly integrator and makes the installation of different electronic components easier for the TC/STC applicant.

However, TSO installation limitations may specify electronic component part numbers and the applicable design features/characteristics (e.g. the seat was qualified with P/N XX-YY-ZZ video display). This would require that the same component be installed or an alternate may be approved by similarity analysis accomplished by the TC/STC applicant relating the new electronics component to the tested component. The TSO seat manufacturer also can specify limitations relative to the TSO-significant design features/characteristics of the electronic components (e.g. the mass of the video display can be no more than 3.5 kg.). This alternative provides the seat assembly integrator with the information necessary to determine whether a specific electronic component is compatible with the seat design for that design feature/characteristic limitation. This will simplify the justification for electronic equipment changes that do not affect form or fit (see Design Approval and Quality Control below).

TC/STC Approval: The TC/STC approval process involves TSOA or LODA seats without the electronic equipment installed. The electronic equipment is subsequently installed by the TC/STC holder. For these seats, the TSO-C127 approval testing should include installed conforming electronics otherwise additional testing may be required. Data outlining the bounds of the seat-significant design features/characteristics outlined below would be provided in the installation limitations by the TSOA or LODA applicant. The TC/STC applicant is responsible for those design features/characteristics of the electronic components specified below and has the responsibility to ensure that the seat TSO approval is not violated when the electronics are installed.

Furthermore, when TSO seats are modified by the component equipment manufacturer or their agent under a TC/STC, these modifications require substantiation and the TSO seat must be marked as having been modified (see FAA AC 21-25).

Design Features/Characteristics

Seat design features/characteristics addressed by the TSO are as follows:

SEAT TSO DESIGN FEATURES/CHARACTERISTICS	REMARKS
Electronic component mass	Defines maximum design allowable mass for each electronic component
Electronic component center of gravity	Defines center of gravity range allowable for each electronic component
Method of attachment	Design of method of attachment for electronic components must consider all load cases, not just forward dynamic
Geometry of electronic component	Would benefit from an industry standard
Electronic component flammability	Compliance with 14 CFR 25.853 and 25.869
Sharp edges and corners of electronic component	Compliance with 25.785(d)(2)

Seat design features/characteristics addressed by the TC/STC holder that are considered part of the aircraft installation and that are outside the TSO process are as follows:

TC/STC SEAT DESIGN FEATURES/CHARACTERISTICS	REMARKS
Stiffness of component and mount	Components affected by HIC (14 CFR 25.562(c)(5))
Prevention of damage to components	Physical damage and protection from liquid spills
Wire routing	Occupant protection from shock and mechanical protection of wiring
Surface temperature	Occupant injury concern; damage to seat components
Forces on occupants.	Injuries resulting from powered seat elements

Note: The design features/characteristics above require input from the seat manufacturer, IFE manufacturer and seat installer.

Electromagnetic interference (EMI) generated by electrical component	Non-interference (14 CFR 25.1353(a) and 14 CFR 25.1431 (c))
Electromagnetic susceptibility of electrical component or wiring.	Video and/or audio proper operation and hazards per 14 CFR 25.1309(d)(3)
Power harmonics from electrical component.	Non-interference (14 CFR 25.1353(a) and 25.1431(c))
Electrical fault protection.	Shock, burns, smoke and toxicity (14 CFR 25.831(b))
Heat load generated by electrical component	Cabin temperatures (14 CFR 25.1309(d)(3) for safe operating conditions)
Internal structural integrity of electrical	No hazard under specified g forces (14 CFR 25.561(c)

component.	and 14 CFR 25.789(a))

Design Approval and Quality Control

Design approval responsibility, along with the related QC requirements, is established by the assembly drawing that contains the installation of the electronic component. Under the TSO approval process, the design control and QC for the TSO design features/characteristics are the responsibility of the seat TSOA or LODA holder. The seat TSOA or LODA holder is also responsible for flow down of the TC/STC holder's design and QC requirements to the electronics manufacturers. Under the TC/STC approval process, the design approval and QC of all electronic design features/characteristics are the responsibility of the TC/STC applicant.